NASAfacts

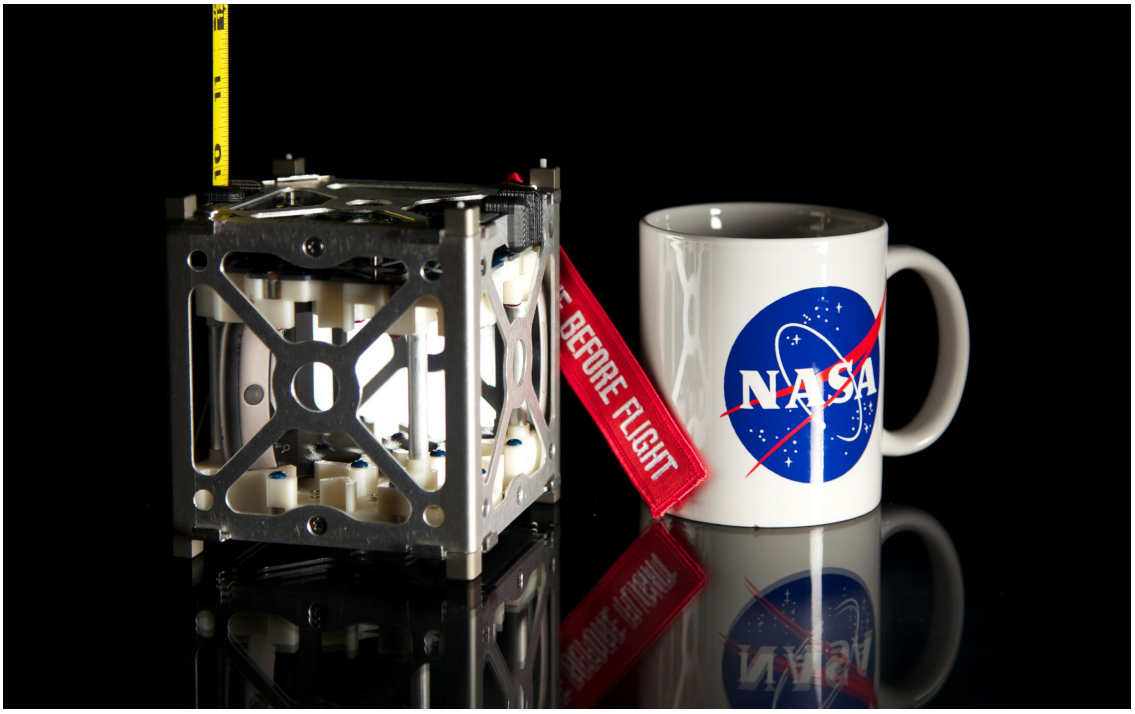
PhoneSat
The Smartphone Nanosatellite

NASA's PhoneSat project will test whether spacecraft can be built using smartphones to launch the lowest-cost satellites ever flown in space. Each PhoneSat nanosatellite is one cubesat unit - a satellite in a 10 cm (approx. 4 inches) cube or about the size of a tissue box - and weighs approximately three pounds. Engineers believe PhoneSat technology will enable NASA to launch multiple new satellites capable of conducting science and exploration missions at a small fraction of the cost of conventional satellites.

The small teams of NASA engineers supporting PhoneSat at NASA's Ames Research Center, Moffett Field, Calif., aim to rapidly evolve satellite architecture and incorporate the Silicon Valley approach of "release early, release often," adding new functionality to the satellite with each succeeding iteration.

To do this, the PhoneSat design makes extensive use of commercial-off-the-shelf components, including a smartphone. Smartphones offer a wealth of capabilities needed for satellite systems such as fast processors, versatile operating systems, multiple miniature sensors, high-resolution cameras, GPS receivers, and several radios.

PhoneSat engineers also are changing the way missions are designed by prototyping and incorporating existing commercial technologies and hardware to see what capabilities they can provide, rather than trying to custom-design technology solutions to meet set requirements.



The PhoneSat cubesat bus with a smartphone inside. Image credit: Ben Howard

PhoneSat 1.0
Demonstrates low-cost, modern electronics can fly in space

In 2011, NASA successfully tested a prototype smartphone satellite known as PhoneSat 1.0 in various extreme environments, including thermal-vacuum chambers, vibration and shock tables, sub-orbital rocket flights and high-altitude balloons. PhoneSat 1.0 is built around the Nexus One smartphone made by HTC Corp., running Google's Android™ operating system. The Nexus One acts as the onboard computer; sensors determine its orientation in space, and a camera is used for Earth observations. Commercial-off-the-shelf parts include an Arduino watchdog circuit that monitors the systems and reboots the phone if it stops sending radio signals. The PhoneSat 1.0 satellite has a basic mission goal -- to stay alive in space for a short period and send back health and picture data.

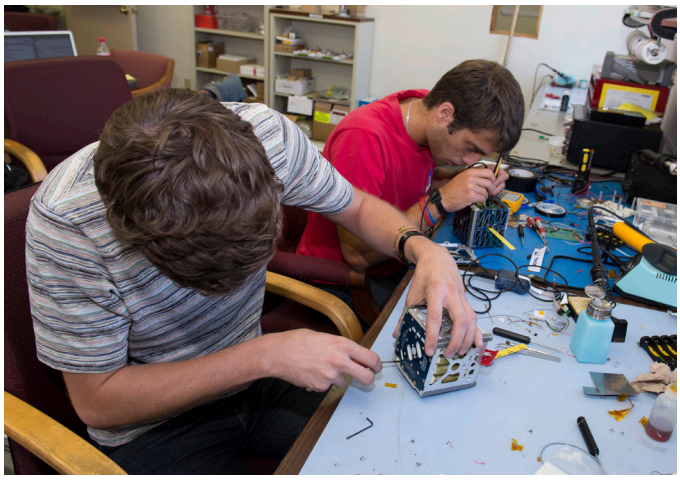
PhoneSat 2.0
Demonstrates complete functionality in a low-cost satellite package

PhoneSat 2.0 will build on and supplement the capabilities of PhoneSat 1.0 by adding a two-way S-band radio to allow engineers to command the satellite from Earth, solar panels to enable longer-duration missions, a GPS, magnetorquer coils and reaction wheels to actively control the satellite orientation in space. PhoneSat 2.0 also will equip a newer Nexus S smartphone made by Samsung Electronics running Google's Android™ operating system to provide a faster core processor, avionics and gyroscopes.

The PhoneSat 2.0 bus will bring new capabilities to a satellite of such small size while advancing breakthrough technologies and decreasing costs. Possible PhoneSat 2.0 mission goals include:

- Using distributed sensors to measure space weather phenomena
- Qualifying new technologies and components for space flight
- Tracking orbital debris and near Earth objects
- Conducting low-cost Earth observations

The PhoneSat project is a technology demonstration mission funded by NASA's Space Technology Mission Directorate at NASA Headquarters and the Engineering Directorate at NASA Ames Research Center. The project started in summer 2009 as a student-



led collaborative project between Ames and the International Space University, Strasbourg.

Engineers kept the total hardware cost per satellite to $3,500 by strictly utilizing commercial-off-the-shelf hardware and keeping the design and mission objectives as simple as possible.

Two PhoneSat 1.0 and one PhoneSat 2.0 Beta prototype satellites launched on April 21, 2013 aboard the maiden flight of the Antares rocket developed by Orbital Science Corp., Dulles, VA.

For more information about PhoneSat, visit:
http://www.nasa.gov/directorates/spacetech/small_spacecraft/phonesat.html

For more information on the upcoming Antares launch, visit:
http://www.phonesat.org

For more information about Ames, visit:
http://www.nasa.gov/ames

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